Basics of Signal Indications and Timings

Signal indications are the primary means of communication between the signal infrastructure and the users of the system. Signals are made up of multiple indications which are either displayed as a ball or arrow depending on the movement or movements controlled by the signal and the color of the indication determines the message conveyed. Signal indications are standardized through the Manual on Uniform Traffic Control Devices (MUTCD), Chapter 4D. The most common signal indications and general timing guidance is summarized below:

Green Indication:

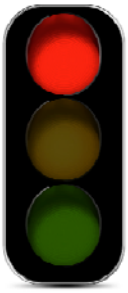
Traffic facing a green indication are permitted to proceed through the intersection for the movements allowed at the signal. The movements can be further identified by the use of an arrow indication to permit or restrict particular movements. For a signal that is traffic actuated the green indication timing is made up of two segments, minimum green and maximum green. The minimum green time is the shortest time that a green indication can be displayed and is typically between 5 to 10 seconds. Once the controller satisfies the minimum green time the controller will then start to monitor the detection at the intersection to determine if there is traffic, if the detection has been inactive for a designated time then the signal will terminate the green indication, if the detection remains active then the signal will continue to display the green indication until the maximum green time has been serviced at which point the signal will terminate the green indication.

Yellow Indication:

The yellow indication is used to alert traffic to an imminent change in the right of way assignment and will commonly follow a green indication. The length of time that a yellow indication is displayed is typically calculated utilizing an equation developed by the Institute of Transportation Engineers and the equation is largely influenced by the speed of the vehicles on the roadway. The equation is designed so that a driver has enough time to determine if they need to stop at the stop bar and the equation is detailed below; where T = driver reaction time, V = speed, a = acceleration due to gravity, and g = grade of the roadway in %:

$$T+\frac{1.47*V}{2(a+32.2*g)}$$

Red Indication:



The red indication alerts drivers that they do not have right-of-way to enter the intersection. After a yellow indication is displayed a traffic signal will typically display a red indication to all approaches, this allows for vehicles that entered the intersection under a yellow indication to clear the intersection before a green indication is displayed to a conflicting approach. Similar to the yellow indication the length of time that a red indication is displayed is also typically calculated utilizing an equation from the ITE and the equation for the red clearance is detailed below, where W = the width of the intersection movement, L = the length of a typical vehicle, and V = speed:

$$\frac{W+L}{1.47*V}-1$$

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